PITT STREET RESEARCH

Black Rock Mining

A rock-solid graphite play

Share Price: A$0.17

ASX: BKT

Sector: Materials

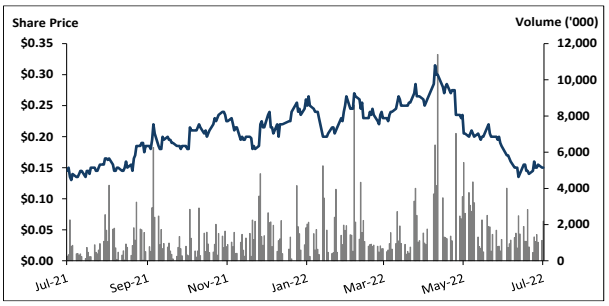
3 August 2022

Black Rock Mining (ASX: BKT) is an Australia-based graphite exploration and development company that owns the Mahenge project – one of Tanzania's largest natural graphite resource. With a mineral resource estimate of 213mt, Mahenge is the world's fourth-largest JORC-compliant graphite resource. The project's enhanced Definitive Feasibility Study (eDFS) outlines a compressed development schedule comprising four production modules with a total planned annual capacity of 350kt. This will make BKT potentially one of the largest graphite producers globally.

Market cap. (A$ m)	166.1
# shares outstanding (m)	977.3
# shares fully diluted (m)	1,041.2
Market cap ful. dil. (A$ m)	177.0
Free float	87.0%
12-months high/low (A$)	0.33 / 0.13
Avg. 12M daily volume ('1000)	1,475.9
Website	blackrockmining.com.au

Source: Company, Pitt Street Research

Share price (A$) and avg. daily volume (k, r.h.s.)



Source: Refinitiv Eikon, Pitt Street Research

What differentiates the Mahenge project?

The Mahenge graphite project is a long-life, operationally de-risked, and an open-pit project. The high-quality geology and favourable location of the project contribute to a significantly low capital expenditure requirement and limited technical risk. Further, low deleterious elements and favourable metallurgy enable the company to produce high-grade purity products through the use of conventional floatation processing alone. As a result of these multiple benefits, the project has compelling economics demonstrated through an after-tax net present value (NPV) of US$1.16bn (after 16% free carry), an internal rate of return (IRR) of ~45% and a payback period of ~4 years.

Strategic alliances de-risk the project

BKT achieved a significant milestone for project de-risking and debt financing by entering into offtake and product prepayment agreements with POSCO, which is a key player in the global lithium-ion-battery industry and one of the largest anode feedstock producers. The POSCO Group is also a major shareholder in BKT and currently owns a 13% stake in the company. Additionally, the framework agreement signed between BKT and the Tanzanian government covering a 16% free carried interest provision, is expected to support the project's lucrative prospects.

Valuation range of A$0.88–1.14 per share

We have valued BKT at A$0.88 per share base case and A$1.14 per share optimistic case using the DCF approach, with key assumptions based on the assumptions of the enhanced DFS for the Mahenge graphite project. We foresee BKT being re-rated upon timely completion of project financing and construction commencement. The key risks we see are: 1) funding risk; 2) commodity risk; 3) sovereign risk; and 4) geological risk.

Valuation metrics	
DCF fair valuation range (A$)	0.88–1.14
WACC	10.8%
Assumed terminal growth rate	1.0%

Source: Pitt Street Research

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Disclosure: Pitt Street Research / Stocks Down Under directors own shares in BKT.

Please refer to page 19 for key investment risks.

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Introducing Black Rock Mining

Listed on the ASX, Black Rock Mining (ASX:BKT) is a graphite exploration and development company that owns the Tanzania-based Mahenge graphite project, the world's fourth-largest graphite resource. Mahenge is amongst the largest JORC-compliant graphite resources globally with a mineral resource estimate of 213mt @7.8% total graphite carbon (TGC). It also has ore reserves of 70.5mt @8.5% TGC, which support a life of mine (LOM) of 26 years. Mahenge is spread across 324 sq km of exploration tenements in the Ulanga district. It lies ~250km from Mozambique, 250km from the coastal port city of Mtwara & 300km from Tanzania's capital, Dar es Salaam.

The Mahenge project is amongst the largest natural graphite resources in Tanzania

Mahenge – the black gold project

The Mahenge project is a very unique and lucrative project. The project's eDFS, which was initially conducted in October 2018 and subsequently enhanced in 2019, pictures a four-stage (or module) construction schedule, with the first module scheduled in Q4 CY23, a total planned annual capacity of 350kt. This makes BKT one of the world's largest potential graphite producers. The enhanced DFS highlights superior economics and low capital expenditure along with low technical risk, which was supported by two successful pilot plant runs in Canada (90 tonnes) and China (18.5 tonnes). The project is expected to deliver a post-tax NPV of USD$1.16bn and an impressive IRR of ~45%.

In our view, demand prospects of graphite remain robust, underpinned by growing decarbonisation and electrification of transportation. It is a well-established fact that there is more graphite in lithium-ion batteries by volume than any other material, regardless of battery chemistry. Consequently, it is estimated that global graphite demand will double by 2027 with a supply deficit of ~400ktpa by 2026.

POSCO deal provides qualified path to market

BKT is completely focussed on upstream operations. However, it has partnered with a strong downstream player – POSCO, which is one of the world's largest battery anode material producers and a key participant in the global lithium-ion battery industry. The alliance between the two companies involves POSCO's 13% stake in BKT along with an offtake agreement with a US$10m prepayment facility. POSCO also conducted the due diligence, attained regulatory approvals, conducted supply chain testing, and extensive qualification activities to validate the commercial credentials for the project.

Additionally, BKT signed a framework agreement with the Tanzanian government to jointly develop the Mahenge project through a joint venture company, Faru Graphite Corporation. The agreement, under which the Tanzanian government holds a 16% non-dilutable interest in the project, is expected to support the project's prospects.

The Mahenge project is ready for take off

The project is now in the advanced stages with all the key environmental approvals, mining licenses, and other permits in place. The government has agreed to consolidate the company's mining licenses into a Special Mining License which is expected to be issued in the near term. Offtakes for up to 90% of module 1 of Mahenge's production have been signed and project

financing is also nearing completion. BKT plans to begin construction this year and the first production from module 1 is targeted for H1 of 2024.

Ten reasons to look at BKT

Low levels of impurities will result in high-grade, green and differentiated high-margin products

1) **Mahenge is amongst Tanzania's largest natural graphite resources** – The Mahenge project has a huge resource base with a mineral resource estimate of 213mt @7.8% TGC. It is the second-largest reserve globally and the fourth-largest JORC compliant flake graphite resource in the world. The project is expected to deliver 350kt per annum of 98.5% graphite concentrate for 26 years.
2) **Favourable geology** – The Mahenge graphite resource has very low levels of impurities. It can be processed using the conventional water-based flotation method and does not require typical acid interference. In fact, the site has the highest grade and cleanest graphite concentrates globally due to favourable metallurgy, good distribution of large flake sizes and low strip ratios. The high levels of purity result in products that have lower capital and operating costs and lesser environmental impact, which eventually translate into high-margin products.
3) **Close proximity to existing infrastructure** – Mahenge is well-positioned in Eastern Africa's growing graphite belt. The project has a number of key competitive advantages with access to established infrastructure such as low-cost green grid power (~70% hydro, ~30% gas), rail and a container port. The project is llocated 60km from the 220kV national grid pwer network. Tanzania Electric Supply Company has also proposed to connect the local power network to the project site. Dar es Salaam, the main deep-water high-volume container port for Tanzania that handles about 95% of Tanzania's international trade, is located 450km by road from the site. The port can also be reached by rail line, which is about 70km north of the project.
4) **BKT's alliance with POSCO** – BKT's strategic alliance with POSCO is a key differentiating point for the company and should provide investors with confidence in the project and the company. POSCO is a cornerstone offtake partner, a major shareholder in BKT (with a 13% stake) and provides a visible path to customer markets. It currently has an offtake agreement in place with a US$10m prepayment facility.
5) **Strong project economics** – The Mahenge project has superior project economics and is expected to deliver an impressive after-tax NPV of US$1.16bn, IRR of ~45% and All-in Sustaining Costs (AISC) margin of ~63%. It has a short payback period of 3.8 years from the time of processing of the first ore. The above financials are likely to translate into a stable EBITDA of US$306m per annum after the fifth year (at a basket price of US$1,301/t for 97.5% concentrate). The company is targeting debt financing of 50-60% for module 1 of the project. Thereafter, the remaining modules of the project are likely to be funded from internal cash flows.
6) **Strong offtake agreements reduce attached risk** – BKT has secured offtakes (or options) for up to 90% of module 1 of Mahenge's production. This includes an agreement of 30kt with POSCO under which BKT will hand over 100% of its planned fines production from Mahenge's module 1 to POSCO. The company also has binding offtake agreements with Taihe

Soar Supply Chain Management (20ktpa) and Qingdao Yujinxi Material Co. (10ktpa) for the supply of large flake concentrates. These binding agreements significantly lower the project's risk. Additionally, BKT's recent memorandum of understanding (MOU) with US-based Urbix, an environment-friendly graphite processing company, opens doors for Mahenge's graphite into the US markets.

7) **Increasing demand for graphite** – Demand for graphite is set to double globally by 2027, thanks to increasing decarbonisation and rising interest in electric vehicles (EVs). Supply, on the other hand, is likely to remain constrained due to the lengthy qualification requirements for new graphite projects. By 2026, a supply deficit of ~400ktpa is anticipated.
8) **Tanzania's new openness to business investment**– Tanzania has long struggled with its deteriorating perception in the ease of doing business. However, things have improved following a change in leadership to current President Samia Suluhu Hassan in March 2021. The current government aims to improve the business climate, attract foreign investment and form partnerships with the world's largest miners. The government under President Samia is looking to boost the mining sector's contribution to at least 10% of GDP by 2025.
9) **Management team with rich experience** – BKT's board and management teams have solid experience in metals and mining, and financial services industries. We believe BKT's leadership exhibits required expertise to enable the company to achieve its long-term objectives.
10) **BKT is undervalued** – We believe the stock is undervalued at its current market value. We value the company at A$0.38 per share base case and A$0.51 per share optimistic case using the DCF approach. The key near-term catalysts for the stock will be timely completion of project financing and construction commencement which should provide investors the confidence that the company is on track to attain its potential.

Strategic benefits of the Mahenge graphite project

The Tier 1 scale Mahenge Liandu graphite project is located in the Ulanga district in Tanzania. This project is a large, open-pit graphite mine with a unique combination of high-quality geology and world-class geography.

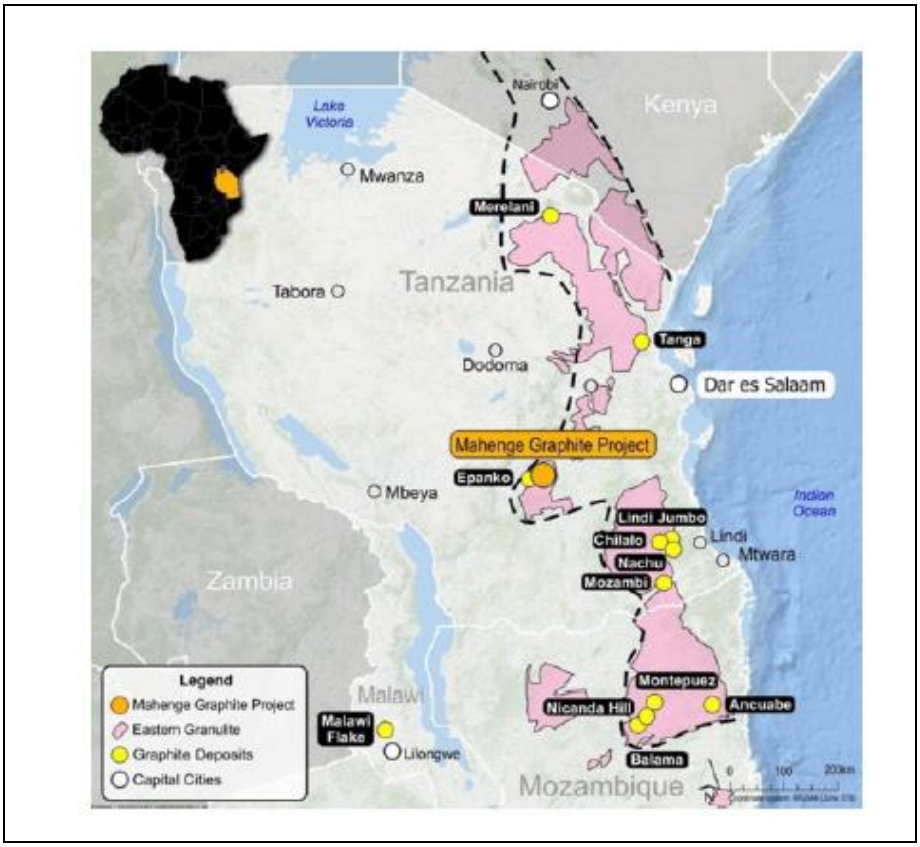
Favourable geology and location

The project's excellent geology stems from its potential to produce high-quality products from a large flake size, industry-leading concentrate grades, potential for increasing production from underexplored deposits, low costs, simple metallurgy and options to produce multiple product grades.

The project benefits from a favourable geography. The project's area spans 324 sq km of exploration dwellings in the Ulanga district, approximately 250km north of the Mozambique border. Its premier location within the Proterozoic Mozambique Orogenic belt expanding through East Africa (Figure 1) makes it a beneficiary of differentiation, which in turn is likely to contribute to the project's value creation.

The Mahenge project is well-positioned within the Eastern African Belt

Figure 1: Significant deposits in Eastern African Belt

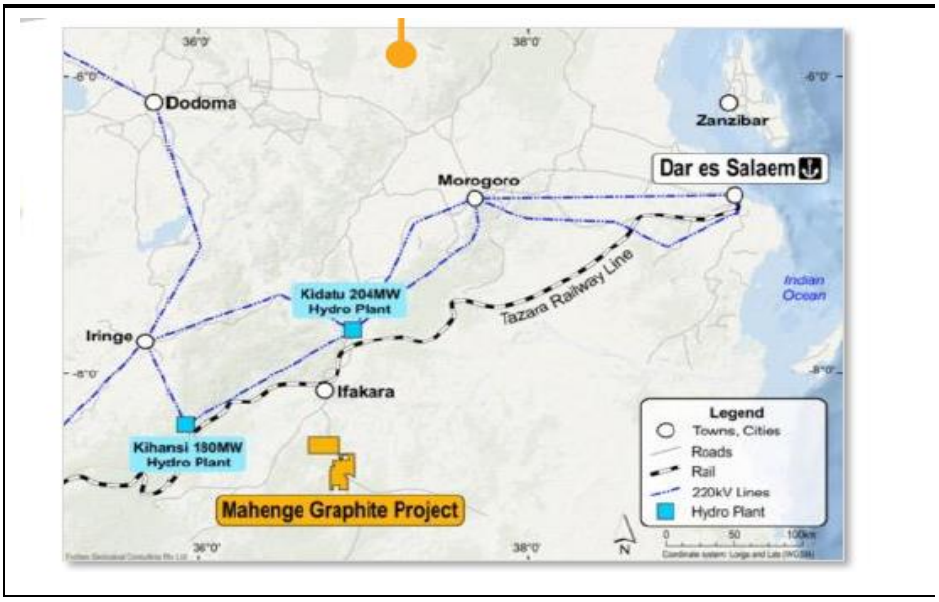


Source: Company

BKT will significantly benefit from direct access and proximity to Dar es Salaam, which handles ~95% of Tanzania's international trade

Mahenge's location offers significant competitive cost advantages, such as a ready pathway for strong logistics through access to grid power and trucking supply routes. Mahenge is well-placed to benefit from its proximity and direct access to the rail and major port at Tanzanian city, Dar es Salaam (Figure 2). Dar es Salaam is the main deep-water high volume container port for Tanzania and handles about 95% of Tanzania's international trade. The port is strategically located to serve as a convenient conduit for freight not only with Eastern and Central Africa but also with the Middle and Far East, Europe, Australia and America. Dar es Salaam minimises frictional cost and mitigates the loss of Free on Board (FOB) value. These key drivers make Dar es Salaam a premier option for the export of graphite products. It does not have any seasonal interruption and covers a larger service area than ports such as Mtwara, Pemba and Necala, which were not selected as they are located at a significant distance from the Mahenge mine site and have high logistics route costs. Dar es Salaam is a major importing port, and as such there is a large number of empty containers heading back to China on multiple sailings every day, leading to very attractive shipping rates back to China, a key competitive advantage for the company.

Figure 2: Access to Dar es Salaam provides Mahenge a key advantage



Source: Company

Huge resource base

BKT carries an existing JORC resource of 213mt and 7.8% TGC

The Mahenge graphite mine hosts a multigenerational resource with a total resource of 213mt @7.8% TGC, which makes it the second-largest reserve globally and the fourth-largest (JORC compliant) flake resource in the world. Currently, the Mahenge project has the largest measured graphite mineral resource globally (Figure 3 and Figure 4). This development came on the back of an increase in the measured mineral resource by 25% in February 2022 following the completion of the infill drill programme and bulk metallurgical sampling. This instils a high degree of confidence in customers and financiers regarding the production output that has been planned over the first 10 years of operation. The project will deliver 350kt per annum of 98.5% Loss on Ignition (LOI) premium graphite flake concentrate over a mine life of 26 years, after which the current defined deposits will be depleted.

Figure 3: JORC-compliant mineral resource estimate and ore reserve*

Ore Reserves	Tonnes (mt)	Grade (% TGC)	Contained Graphite (mt)
Proven	-	-	-
Probable	70.5	8.5	6
Total Ore Reserves	**70.5**	**8.5**	**6**
Mineral Resources			
Measured	31.8	8.6	2.7
Indicated	84.6	7.8	6.6
Total M&I	**116.4**	**8.0**	**9.3**
Inferred	96.7	7.4	7.2
Total Measured, Indicated & Inferred	**213.1**	**7.8**	**16.6**

**Resource and ore reserve estimates as released to ASX on 3 February 2022*
Source: Company

Figure 4: Mineral resource estimate and ore reserve by prospects in the mining area

Prospect	Category	Tonnes (mt)	TGC (%)	Contained TGC (mt)
Ulanzi	Measured	19.6	8.8	1.7
	Indicated	46.2	8.2	3.8
	Inferred	48.7	7.8	3.8
	Sub-Total	**114.5**	**8.1**	**9.3**
Cascades	Measured	12.1	8.3	1.0
	Indicated	20.8	8.3	1.7
	Inferred	27.3	7.9	2.2
	Sub-Total	**60.2**	**8.1**	**4.9**
Epanko	Measured			
	Indicated	17.6	6.4	1.1
	Inferred	20.8	5.9	1.2
	Sub-Total	**38.4**	**6.1**	**2.4**
Combined	**Measured**	**31.8**	**8.6**	**2.7**
	Indicated	**84.6**	**7.8**	**6.6**
	Inferred	**96.7**	**7.4**	**7.2**
	TOTAL	**213.1**	**7.8**	**16.6**

Source: Company

An upstream-only player with low capital outlay

Upstream-only mine development strategy lends a significant advantage to BKT compared to other graphite developers

BKT has a core upstream and mine development strategy for the Mahenge project wherein it will only focus on providing premium large flake concentrates to processors. It has not attempted entry or penetration in the downstream market. This strategy will allow a capital-light business model and place the company in a better position vis-a-vis many of its graphite development peers.

Importantly, the Mahenge project is likely to be a low-cost supplier to the graphite industry. The enhanced DFS in 2019 showed robust financial metrics of which low capital outlay was a key one. The project would entail a low peak capital expenditure of US$116m. The low peak capital intensity is driven by a four-staged bootstrapping process using internal cash flows and high-grade deposits.

Figure 5: Capex at peak levels for the Mahenge project to remain low

Area	Stage 1 US$000	Stage 2 US$000	Stage 3 US$000	Stage 4 US$000	Total US$000
Mining	10,165	-	-	-	10,165
Ifakara	1,366	1,041	727	682	3,816
Infrastructure	14,315	3,325	53,705	40,976	112,321
Process Plant	50,877	45,300	4,737	4,293	105,207
Site Support	1,767	194	194	194	2,349
Indirects	9,904	6,955	8,468	6,955	32,282
Owners Costs	16,174	5,160	6,294	5,160	32,788
Contingency	11,000	7,500	11,200	8,800	38,500
Total	**115,569**	**69,474**	**85,324**	**67,060**	**337,428**

Source: Company

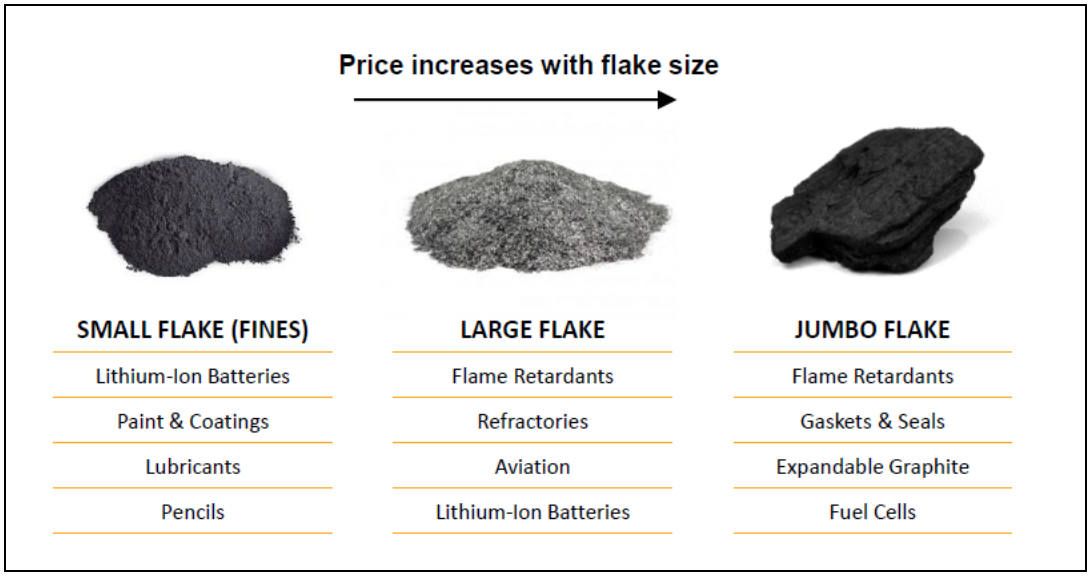
Strong purity level of products help target high-margin large graphite flake market

Low deleterious impurities and favourable metallurgy enable BKT to benefit from leading product purity and residual chemistry

BKT has a diversified product mix with 60% exposure to the high-margin large flake market. The Mahenge graphite mine's mineral resource has industry-leading high-grade purity resulting from low deleterious elements and favourable metallurgy, a good distribution of large flake sizes, and low strip ratios. The company can achieve a 99%+ TGC concentrate purity with a conventional floatation processing at a commercial scale. Additionally, the project offers cleanest graphite concentrates globally, which reduces energy consumption levels.

The capacity to generate high-grade products using floatation is of key value to downstream processors since they have been facing environmental constraints. This in turn results in a reduction in capital and operating costs, a decrease in the impact to the environment and a highly differentiated green product. The Mahenge project will mainly target the large graphite flake market (Figure 6) and the company plans to achieve a high AISC) margin of 63%+ (assuming average graphite basket price of ~US$1,301/t vs. C1 operating cost of ~US$397/t). In total, the mine will produce three grades of product offering the flexibility to the company to switch capacity. Additionally, the project has a low LOM strip ratio of 0.8:1.

Figure 6: BKT will have a high exposure to the large flake market



Source: Company

Graphite concentrate meets export regulations set by Tanzania

In September 2020, the Tanzanian government published revised regulations for graphite concentrate exports, replacing the Mining Guidelines of 2019. The updated regulations permit the export of graphite concentrate that has a TGC content above 65% (subject to laboratory tests).

As per the three pilot plant runs in Canada and China, totalling an industry leading ~610t, the Mahenge project demonstrated a solid ability to produce

graphite concentrate at grades of up to 98% carbon by LOI, thus far exceeding the 65% threshold and providing certainty of BKT meeting the Tanzanian export regulations. We believe this development is an important milestone for BKT as it provided clarity around graphite concentrate exports, thus confirming the view posited by the enhanced DFS study in 2019 that the concentrate is suitable for export.

Superior economics make the project investment friendly

The enhanced DFS results indicate robust project economics

The enhanced DFS study of the project provides compelling economics with construction underwritten by binding offtake agreements. The excellent forecasted economics translate to a strong profitability outlook for BKT. As per the enhanced DFS, the Mahenge project is expected to deliver an after-tax NPV of US$1.16bn, IRR of 44.8%, AISC margin of 63.1% and payback period of 3.8 years. The company is likely to witness a stable EBITDA of US$306m per annum after the fifth year at a graphite basket price of US$1,301 per tonne (Figure 7).

Figure 7: Mahenge project's key financial metrics

Financial Parameter	Unit	LOM
Project Life	Years	27.5
Operating Life	Years	26
Graphite Price	US$/t	1,301
Total Project Development Capital Costs	US$M	337
C1 Cost: Real (including withholding tax)	US$/t	397
Stable State EBITDA (after year 5)	US$M, real	306
Project NPV @10% - Post Tax, Ungeared after 16% Free Carry	US$M, real	1,161
Project IRR - Post Tax, Ungeared after 16% Free Carry	% Nominal	44.8
Maximum Cash Draw Period - from Construction Start	Years	3.5
Breakeven Graphite Price	US$/t	576

Source: Company

Mahenge is a significantly de-risked project

In our view, BKT's Mahenge graphite project is not only a high-potential project but one with limited risks. We think there are a number of strong reasons supporting the low risk profile of this project.

A Qualified path to market through strategic alliances and offtake agreements

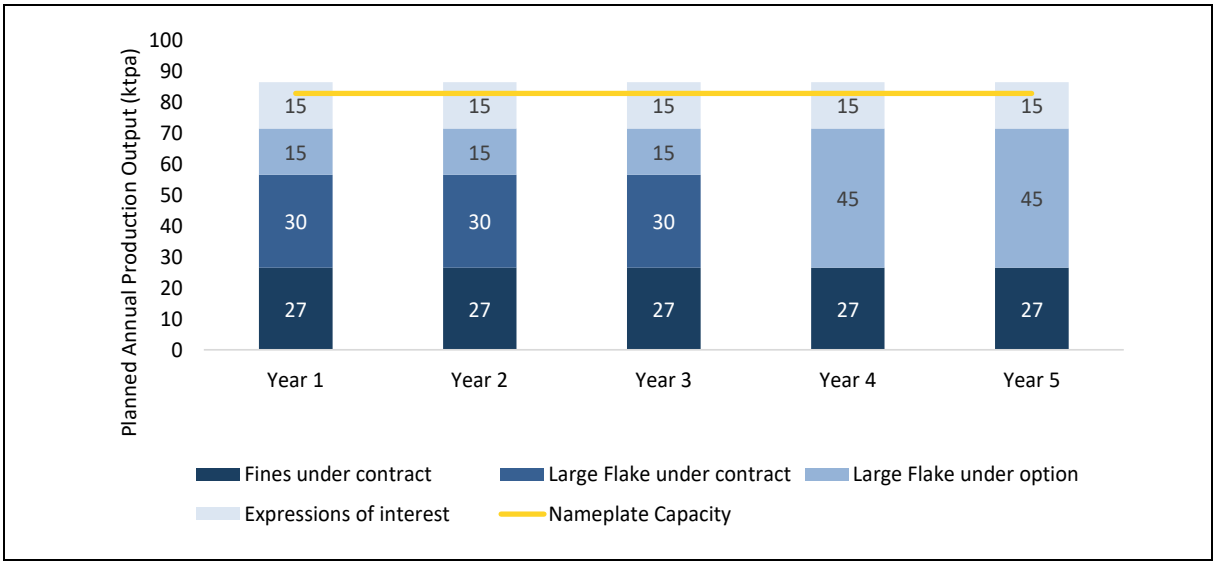
A key development for BKT was the strategic alliance with the POSCO Group in June 2020 as a cornerstone offtake partner and major shareholder for the development of the Mahenge graphite mine. The POSCO Group is one the

largest anode feedstock producers and a major player in the global lithium-ion battery industry. In May 2021, the Tanzanian government's Fair Competition Commission (FCC) approved POSCO's 13% equity investment in BKT for US$7.5m.

Almost 90% of production under module 1 is under binding offtake agreements

In August 2021, two existing Chinese price and volume agreements (pertaining to the supply of large flake concentrate) were converted to binding term sheets, thus instilling a high degree of confidence in BKT's prospects. Currently, almost 90% of Mahenge's production under module 1 are under binding offtake agreements (Figure 8).

Figure 8: Mahenge offtake for module 1 (83ktpa)



Source: Company

The strategic alliance with POSCO to reduces the project's offtake credit risk and support BKT's project financing efforts

In December 2021, BKT signed a term sheet with POSCO for product prepayment commitments for US$10m and offtake for 100% of planned fines production under module 1 of the Mahenge project. Signing of the term sheet with POSCO is an important milestone for the financing and development of the project.

Further, strategic discussions between BKT and Urbix (a US Clean Tech graphite processing company) are currently in progress. The discussions follow an MOU signed by both parties in July 2021. The MOU was signed to achieve collaboration in innovative supply chain to process battery anodes. This would further provide potential offtakers with an alternative supply chain option in the US and other western regions. Moreover, Urbix's strong technology is likely to enhance the ESG footprint across the supply chain of battery anodes, thus providing environmental and economic benefits to customers.

Financing strategy to receive a boost from binding offtake agreements

BKT is targeting a debt level of 50-60% through a blended project financing model. The formal debt process for the project financing is underway and is likely to be finalised in the next few months. Discussions with potential

lenders are likely to receive strong support backed by the milestones achieved by BKT till date. These include the term sheet signed with POSCO, a framework agreement signed with the Tanzanian government with 16% free carried interest, and completion of the graphite sector's largest customer qualification programme for a large-scale pilot plant processing 600 tonnes of bulk graphite.

The alliance with POSCO provides a significant advantage to BKT for gaining access to project finance. It substantially lowers the project's offtake credit risk, which is necessary to gain access to debt financing in the future. BKT's access to international debt markets is also likely to receive a boost from transparent pricing and volume commitments from POSCO.

Going forward, the company aims to achieve certain critical de-risking milestones (Figure 9):

- **Project milestones:** BKT aims to finish early works and the Resettlement Actions Plan (RAP).
- **Offtake milestones:** BKT aims to add incremental offtake partners for module 1 and complete full agreements with offtake partners for prepayments.
- **Project debt milestones:** These include indicative term sheets and credit-approved term sheets provided by lenders.

Figure 9: BKT is focussed on runway to construction

Source: Company

Mahenge is poised to take off

All environmental approvals, mining licenses and RAP needed for Mahenge have been secured by BKT with a clear title to the project area in the enhanced DFS. Land and property values are being evaluated, and relocation of people and properties are being supported through RAP. BKT completed field activities in Tanzania and the RAP process for resettlement of affected persons affected by the project development with an acceptance rate of >98%, and 99% of participants willing to relocate voluntarily before arbitration.

BKT intends to commence mine construction this year

Two contiguous mining licenses ML00611/2019 and ML00612/2019 have also been granted, assuring the stakeholders that the Tanzanian government is keen for the project to be developed. The Government of Tanzania has agreed to consolidate these mining licenses into a Special Mining License (SML) held by the Faru Graphite Joint Venture (established as part of the agreement between BKT and the Tanzanian government). Issue of the SML is expected near term

With the receipt of all permits required to commence construction, and signing of the offtake and the FCI agreement with the Tanzanian government, the Mahenge project is at a critical juncture in the development cycle. BKT intends to commence the first production (from module 1) by H1 2024.

Cash buffer expected to support smooth take-off

As of June 30, 2022, the company had a cash balance of A$26.2m. The cash balance is sufficient to meet its financial obligations in the near term. Additionally, the funds raised from the recent placement (A$25m) are likely to be directed towards the development of the Mahenge graphite mine, including the early works programme and for general and corporate purposes. Total capital expenditure of the project for all modules increased from US$269m in the October 2018 DFS study to US$337m in the enhanced DFS. Out of this, US$222m for modules 2, 3 and 4 would be funded from internal cash flows.

Industry leading results generated from recent pilot plant runs

BKT has successfully conducted a number of test runs and pilot plant operations over the past five years that help support its claim of low technical risk of the Mahenge project.

~70% of the primary cleaning circuit for the Ulanzi product contained flake sizes above 80 mesh (180 microns)

– **In May 2018**, BKT delivered an ultra-high graphite concentrate grade of over 99% under its pilot plant test works conducted at SGS Lakefield in Canada. The plant processed 90 tonnes of Mahenge graphite ore which consisted of 50 tonnes from Cascades and 40 tonnes from Ulanzi. The 97.5% premium concentrate achieved in the test works was reprocessed to produce the ultra-grade concentrate of >99% (as depicted in Figure 10).

Figure 10: Ultra-Class concentrate flake distribution

Size		% Retained Individual	Grade C (t)%[3]	Distribution C(t)%
Mesh[1]	Um[2]			
32	500	0.2	99.1	1.6
48	300	12.9	99.8	25.9
65	212	25.3	99.7	32.3
80	180	16.6	98.4	16.2
100	150	16.4	99.6	9.3
150	106	11.1	99.1	7.3
200	75	7.1	99.3	3
-200	-75	10.4	99	4.4
Total (calc)		**100**	**99.3**	**100**
Total (direct)				
K_{80}		**276**		

[1]Mesh sizes are used to describe flake size and refer to dimensions of the mesh size opening. As per American Society for Testing and Materials (ASTM), mesh sizing refers to the number of openings per linear inch. A product identified as -200 mesh would indicate only particles that passed through a 200 mesh screen. A +200 grade would contain particles that did not pass through a 200 mesh screen.
[2] Um (micrometre/micron) is the measure of length most frequently used to describe tiny particle sizes.
[3]Grade C refers to the carbon content in the concentrate.
Source: Company, Pitt Street Research

An enhancement in plant operations will be achieved through optimisation of flowsheets

The testing of the pilot plant is focussed on the attainment of flowsheet optimisation for ore processing from the Ulanzi deposit. This is critical for optimising plant operations which would help to achieve improvements across capital and operating costs.

- **In April 2019**, BKT announced the successful completion of the testwork of a pilot plant processing 18.5 dry tonnes of ore operated by BKT's EPC partner Yantai Jinyuan Mining Machinery. The second round of the testwork enables BKT to de-risk the Mahenge project, attract financing and open a new market channel for product placement given Yantai's reputation for delivering quality graphite products. This pilot plant run in China not only achieved replication but also improvement in the industry-leading processing performance from the previous one.
- **In August 2019**, battery anode precursor trials produced spheronising yields of 53% and final purity of 99.98% total graphitic carbon, well in excess of industry standards of 35-45% and 99.95%, respectively. This achievement demonstrated the preservation of the integrity of the flake without impairment in spheronising performance.
- **In November 2020,** successful testing of lithium-ion battery cells for POSCO's anode business was conducted by producing Spherical Purified Graphite (SPG) from Mahenge graphite on a small scale. This, coupled with the processing and coating of the anodes done using POSCO's proprietary methods, resulted in the Mahenge graphite concentrate meeting the battery-grade requirements for the precursor for lithium-ion battery anodes. The industry-leading results reiterated the company's confidence in the strategy of collaborations with existing anode producers, SPG outsourcing and refining to cost-competitive intermediaries.

Mahenge graphite concentrate meets battery grade requirements for lithium-ion battery anode precursors

– **In December 2021**, operations of the Qualification Plant, a large-scale pilot plant processing 500 tonnes of bulk graphite, were successfully completed. This was an important milestone as it represented the largest customer qualification programme in the global graphite sector. Operations of the plant commenced in August 2021 in China as part of POSCO's equity investment. This enables POSCO and selected large flake customers to secure the necessary customer qualification.

Enhanced DFS delivers stronger results than before

Customer demand and need for an aggressive ramp-up paved the way for the enhancement of DFS study in 2019

The DFS study was optimised in 2019 over and above the original DFS study released in 2018. The main difference between the two studies is the introduction of a fourth module. The enhancement was done to address customer demand and to achieve a more aggressive ramp-up. The compressed development schedule in the DFS study includes four production modules. Each module will be commissioned annually, after the first production (subject to funding). Ore processing would be done from the Ulanzi and Cascade deposits in modules 1 and 2. In modules 3 and 4, Cascade and Epanko deposits will be used to process ore. The enhanced DFS study demonstrated robust financial metrics (Figure 11), and subsequently, in February 2022, the measured mineral resource estimate for the project increased by 25%, culminating in a JORC resource totalling 213mt and a reserve of 70.5mt (As shown in Figure 12). Based on a planned annual production capacity of 350kt of concentrate, this allows for a LOM of 26 years.

The Company is also in the process of completing a Front End Engineering Design (FEED) process which includes:

- Optimisation of the process plant design by incorporating results of the variability testwork program, pilot plant programs and CPC Engineer's expertise in the design of graphite process plants;
- Tender long lead equipment items;
- Provide updated CAPEX and OPEX for project cost and schedule certainty

Figure 11: Key differences – initial DFS vs. enhanced DFS

Metric	Oct 2018 DFS	Jul 2019 Enhanced DFS
Post-tax, unlevered NPV_{10}	US$895m	US$1.16bn
Post-tax, unlevered IRR	42.80%	44.80%
Forecast capex for module 4	n/a	US$67.1m
Forecast total project capex	US$268.7m	US$337.4
LOM C1 Cost, FOB Dar es Salaam	US$401/t	US$397/t
LOM AISC, FOB Dar es Salaam	US$473/t	US$494/t
LOM	32 years	26 years
Average steady state production rate	250,000tpa	350,000tpa
Total LOM Concentrate Production	6.6mt	7.4mt
Reserve Life	23 years	16 years

Source: Company, Pitt Street Research

Figure 12: Updated JORC-compliant mineral resource estimate and ore reserve

	DFS July 2019			Update February 2022		
Category	**Tonnes (Mt)**	**Grade (%) TGC**	**Contained Graphite (Mt)**	**Tonnes (Mt)**	**Grade (%) TGC**	**Contained Graphite (Mt)**
Measured	**25.5**	8.6	2.2	**31.8**	8.6	2.7
Indicated	88.1	7.9	6.9	84.6	7.8	6.6
Inferred	98.3	7.6	7.4	96.7	7.4	7.2
TOTAL	**211.9**	**7.8**	**16.6**	**213.1**	**7.8**	**16.6**

Source: Company

Tanzania is now a mining friendly jurisdiction

The new President aims to improve investment climate and boost Tanzania's mining sector's contribution to GDP

Tanzania has had a poor reputation among ASX investors following laws introduced in 2017 by then President John Magufuli. These included:

- Forced renegotiation of existing agreements between resources companies and the government.
- Removal of terms considered unconscionable by the parliament from investor-state agreements.
- The restriction of repatriation of funds derived from mining activities.
- Increased royalty rates and government shareholding in mineral rights holders, and;
- The banning the export of unprocessed materials to push for local processing.

These measures resulted in a deterioration in the ease of doing business and a big sell off in the shares of ASX explorers with projects in Tanzania.

However, the investment appeal of Tanzania has improved substantially following a change in leadership to current President Samia Suluhu Hassan in March 2021. The current government aims to improve the business climate, attract foreign investment and form partnerships with the world's largest miners. The government under President Samia further aims to introduce measures to boost the mining sector's contribution to at least 10% of GDP by 2025. She intends to make Tanzania a mining friendly jurisdiction and, since taking office, has introduced measures aimed at strengthening mineral marketing and auction centres as well as encouraging the building of mineral refining and processing factories in the country.

In December 2021, an agreement was signed between the Tanzanian government and four mining companies for the formation of joint ventures, re-establishing investors' confidence in the sector. In particular, Faru Graphite was formed by a joint venture between BKT and the Tanzanian government. The Framework Agreement signed between BKT and the Tanzanian government included a provision for free carried interest. Under the provision, the government would hold a 16% non-dilutable shareholding in the capital of all mining companies. This development is likely to result in a contribution of US$6.5bn over a mine life of 26 years. The agreement is also expected to provide significant benefits to Tanzania, such as full-time job creation and new opportunities for ports, rail and power supply. It is also likely to boost global decarbonisation through clean energy storage technologies.

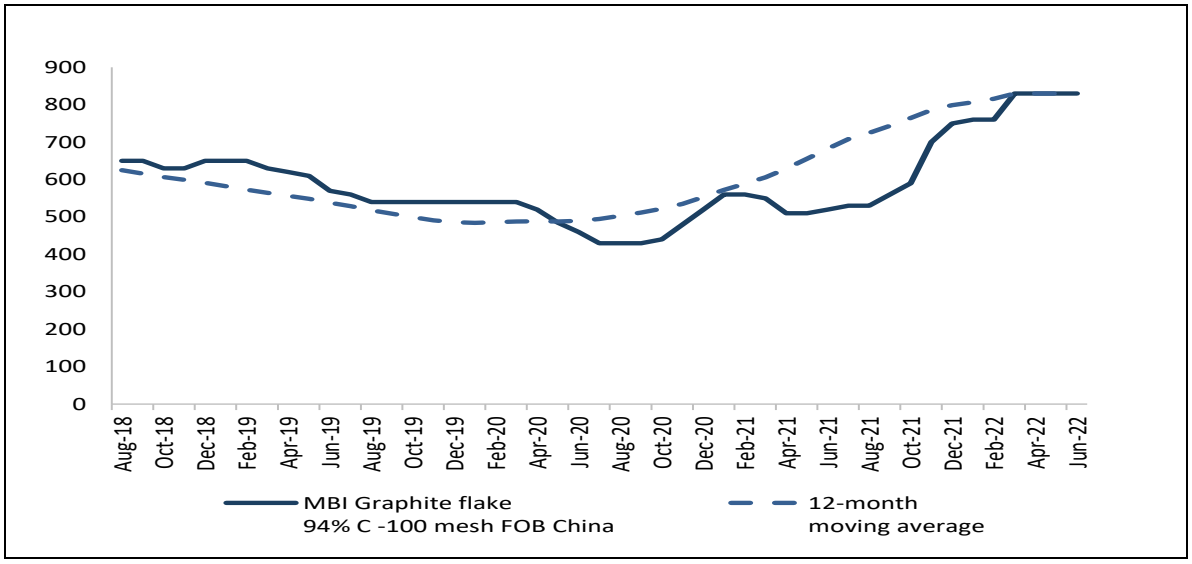
Graphite demand & prices bode well for BKT

Graphite is an important mineral in the world and plays a key role in the path towards decarbonisation. Rapidly increasing demand for graphite has resulted in ~60% price increase of raw graphite from June 2021–2022 (Figure 13). The second half of 2021 witnessed rise in fine flake prices due to challenges with global shipping, power constraints in China, environmental inspections and production suspension during winter. A key downstream customer gaining prominence is the new electric vehicle sector, which has been providing strong support to fine flake graphite since the end of 2020.

Graphite prices increased by 60% over the past year until June 2022

Major consuming countries such as South Korea and Japan have also witnessed an increase in demand despite the COVID-19 pandemic. The prices for fine graphite flake could remain high going forward owing to the strong demand for spherical graphite production in China. The buoyant demand is likely to be directed towards increasing graphite usage to produce anodes and could help to address supply disruptions in major regions and issues with logistics.

Figure 13: History of graphite prices (US$ / t)



Source: Refinitiv Eikon, Pitt Street Research

The electrification of transport will be the major catalyst for graphite demand in the medium

Graphite pricing is a function of concentrate grade or purity and flake size. The higher the concentrate grade and coarser the flake, the higher the price. As of May 2022, graphite prices are nearing the levels used in the DFS study for the Mahenge project. As per Benchmark Mineral Intelligence estimates, a commitment of over US$300bn has been made by major automakers for the development of EVs, with more than 200 lithium-ion battery mega-factories in the pipeline. Lithium-ion batteries contain more graphite by volume than any other material, regardless of battery chemistry. The supply chain of graphite for usage in lithium-ion batteries requires much more reliance on China than any other material. Small flake graphite is majorly being used to produce battery anode material in China due to the former being inexpensive. Premiums for higher-grade concentrates have also increased due to a significant footprint in refining for lithium-ion batteries.

Looking forward, strong graphite demand is likely to underpin a robust outlook for graphite prices. As per industry forecasts, there is likely to be an excess of global graphite demand over supply by 2023. And a qualification requirement adding years to mine development is likely to result in supply constraints. The lack of the ability for graphite hedging and China's strong position in downstream graphite processing could result in challenges in securing project debt by graphite developers. Consequently, structural deficits in natural graphite amounting to 80kt in 2022 are likely to arise and are expected to increase to 400ktpa by 2026. This will be very beneficial for BKT and is expected to aid higher investment in its project.

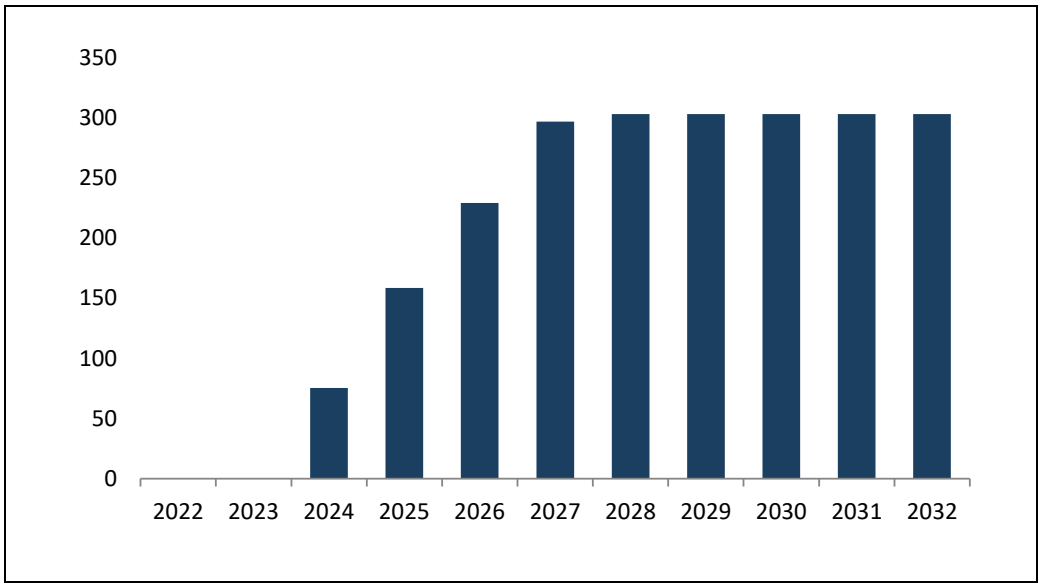
Valuation and Risks

We value BKT at A$0.38 per share base case and A$0.51 per share optimistic case, using the DCF approach based on the assumptions of the enhanced DFS for Mahenge. The key assumptions driving our DCF valuation are outlined below:

– **Ores extracted and production.** We have incorporated the estimated production from all four modules mentioned in the enhanced DFS. We assume that BKT will treat 95m tonnes of Mahenge ore in a four-module approach over a LOM of 26 years (excluding development period). While the total ore treated (capacity) remains same in our base and optimistic case, the extraction ramp-up is faster in the latter case. Further, graphite concentrate produced is computed based on an average feed grade of 8.12% and an average concentrate grade of 96.8% over the mine life. As a result, the total graphite concentrate production during the project life comes out to be ~7.43mt and ~7.45mt in the base and optimistic case, respectively (Figure 14).

Graphite concentrate production during LOM is estimated at ~7.43mt and ~7.45mt for base and optimistic case, respectively

Figure 14: Graphite concentrate production outlook ('000 tonnes, 2022–2032) – Base case



Source: Company, Pitt Street Research

– **Graphite concentrate price.** Our base case assumes an average graphite basket price of US$1,200/tonne, while our optimistic case assumes a 15% higher price, US$1,380/t. Both use a conversion rate of A$1 = US$0.68 (or US$1=A$1.47) and are driven by an expected increase in demand from EVs.

– **Operating costs.** Based on the eDFS, we have assumed long-run operating costs (C1 cost) of US$397/t of ore produced. This includes mining costs (US$106/t), processing costs (US$169/t), and other logistics and administration costs. Further, we have considered a 4.3% royalty on gross revenue in-line with the company's expectations.

A 40:60 debt-equity mix has been assumed

- **Capital costs.** Our model uses total project capital expenditure of US$337m which includes start-up capital cost of US$116m to be incurred before production begins. The remaining amount will be spent over the next three years to initiate modules 2–4 of the project. A sustaining annual capital cost of US$41/t produced has been considered for the LOM.
- **Funding.** We have used a 40:60 debt-equity ratio to fund the start-up capital cost. Debt financing for module 1 is currently underway and is expected to be finalised soon. We assume fresh equity will be issued at the current share price of A$0.16. Moreover, we forecast the company to require minimal additional financing for modules 2–4, funding them mostly through project cash flows. These assumptions significantly impact our valuation – pre-equity financing our valuation is $0.58 in the base case and $0.82 in the optimistic case.
- **Discount rate and terminal value growth rate.** We arrive at a WACC of 10.8% to discount our cash flows, reflecting: a 3.5% risk free rate of return, a 7% equity premium, a 2% country premium, a 1.2 beta, a 14.3% cost of equity and an 8.4% after–tax cost of debt. The cost of equity includes a country risk premium of 2.0%. We have used free cash flow projections for the first 10 years from 2024, and thereafter, a 1.0% long-term growth rate to compute our terminal value.

Mahenge graphite project attains breakeven by year 3 in our base case scenario

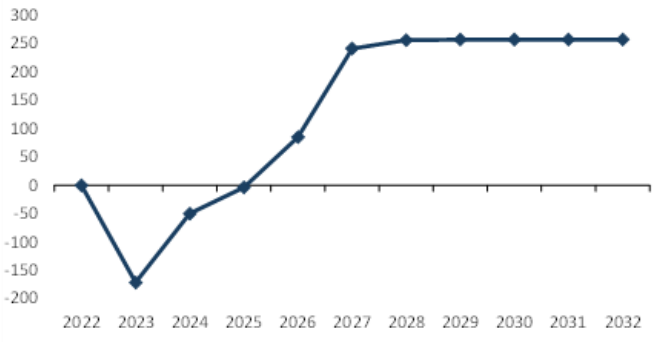
Figure 15 (on page 21) shows our valuation summary for BKT and the upside potential of the stock. Figure 16 (also on page 21) reflects the expected free cash flow profile of the project in our base case. Mahenge attains breakeven by 2026 (two years post production) in our base case and by 2025 (one year post production) in our optimistic case. The project returns an average of ~A$257m and A$296m every year, from year 5 of the project, in our base and optimistic case, respectively.

Figure 15: Valuation summary (post-equity financing)

BKT Valuation (A$m)	Base	Optimistic
Net Present Value	460.4	690.3
Terminal Value	847.7	1,048.8
Net Debt (Cash) (m)	(138.1)	(138.1)
Minority Interest (m)	-	-
Other Investments (m)	-	-
Equity value (m)	**1,446.2**	**1,877.2**
Share Outstanding (Diluted)	1,640.8	1,640.8
Implied Price (A$)	0.88	1.14
Current Price (AS)	0.17	0.17
Upside (%)	418.5%	573.0%

Estimates: Pitt Street Research

Figure 16: Free Cash Flow Generation (A$m, 2022–2032) – Base Case



Estimates: Pitt Street Research

We have accounted for a larger number of shares on issue than at present to account for future capital raises. If we assume no capital raises, our base case is $1.43 while our bull case is $1.88 per share. We also observe that an appreciation of the AUD would reduce our valuation – if we assume parity between the AUD & USD, our base case drops to $0.69 per share, ceteris paribus.

Figure 18: Sensitivity analysis

Sensitivity Analysis						
WAAC	**10.8%**					
Terminal Growth Rate	**1.00%**	**Change in WAAC**				
Implied Price (A$ cents)	**$0.88**	6.8%	8.8%	10.8%	12.8%	14.8%
	0%	$1.53	$1.09	$0.82	$0.64	$0.52
	0.5%	$1.62	$1.14	$0.85	$0.66	$0.53
	1.0%	$1.73	$1.19	**$0.88**	$0.68	$0.54
	1.5%	$1.85	$1.25	$0.91	$0.69	$0.55
	2.0%	$2.00	$1.31	$0.94	$0.71	$0.56

Estimates: Pitt Street Research

Catalysts for re-rating

We foresee BKT being re-rated to our valuation range driven by the following factors:

- Securing project financing (both debt and equity) timely and at a favourable price that will ensure that the project is on track.
- Reaching key milestones in a timely fashion – module 1 construction to commence in Q4 CY2022 and first graphite to be produced beginning CY2024, ramping up to 83ktpa within a year's time.
- Signing of additional binding offtake agreements for further production outputs of the company in modules 2–4.
- Increase in graphite product prices particularly for the fines product, underpinned by growing demand from battery-operated EV manufacturers.
- Further pilot studies that exhibit potential of better mining and financial outcomes as compared to the available data in the enhanced DFS.

Risks

We see the following key risks to our investment thesis:

- **Funding risk.** A critical factor for the success of the Mahenge project is the completion of project financing in a timely manner. The project is in the financing stage and requires debt and equity capital for commencement of construction. We have assumed that the company will commence graphite production in CY2024. However, in case there are delays due to funding challenges, this will affect cash flows and viability of the project.

- **Underlying commodity risk**. BKT is exposed to commodity price risk, which depends on macroeconomic factors and industry demand-supply dynamics. BKT's cash flows and profitability could be impacted due to fluctuations in the Australian dollar and the price of graphite.
- **Sovereign risk.** Investment in BKT is exposed to Tanzanian sovereign risk. Although Tanzania benefits from the return to a stable and safe jurisdiction following the appointment of Samia Suluhu Hassan as President, it remains a riskier jurisdiction compared to Australia and other Western jurisdictions.
- **Geological risk.** The resources for Mahenge project are estimates. There could be a downside risk if a portion of resources is re-categorised as inferred resources at a later stage.

BKT leadership possesses rich experience

The board and management team (Figure 17) of BKT has robust experience across resources and financial services industries. We believe BKT's leadership has the relevant expertise and network to lead the company through its different growth stages.

Figure 17: BKT's leadership composition

Board of Directors	
Name and Designation	**Profile**
Richard Crookes Non-Executive Chairman	– Mr. Crookes is a geologist with over 30 years' experience in the resources and financial services industries. – He has strong experience in raising capital for a number of projects globally, including across Africa. – He is a fellow of The Financial Services Institute of Australasia (FINSIA), and a member of the Australasian Institute of Mining and Metallurgy (AusIMM) and the Australian Institute of Company Directors (AICD).
John de Vries Managing Director and CEO	– Mr. de Vries has over 35 years' experience in mine development and operations across Africa, the Pacific, the Former Soviet Union, North and South America, and Australia. – He previously worked as a General Manager Technical Services with St. Barbara and held operational management roles at BHP Nickel West, Orica Mining Services and Western Mining Corp. – He is a fellow of the FINSIA and a member of the AusIMM and SME.
Ian Murray Non-Executive Director	– Mr. Murray has over 20 years' corporate experience in the publicly-listed resources sector. – He has successfully led several project developments, acquisitions, company restructures and stock exchange listings. – Mr. Murray is a member of both the South African Institute of Chartered Accountants and the Institute of Chartered Accountants of Australia and New Zealand. He is also a member of the AICD.

Gabriel Chiappini Non-Executive Director	– Mr. Chiappini is a Chartered Accountant with over 20 years' experience in the commercial sector. – Over the last 15 years, he has held positions of Director, Company Secretary and Chief Financial Officer in both public and private companies with operations in Australia, UK and US. – Mr. Chiappini has a Bachelor of Commerce degree with a double major in Accounting and Finance.

Source: Company

Management Team	
Paul Sims Chief Financial Officer	– Mr. Sims has over 25 years' executive experience in the resources industry, spanning commercial and financial roles at BHP, Western Mining Corp, Minara Resources and Karara Mining. – He possesses extensive experience in debt finance, project management and cost control. – He holds a Bachelor of Business degree from Curtin University and is a Fellow of CPA Australia.
Greg Wheeler Chief Commercial Officer	– Mr. Wheeler is an experienced finance and commercial manager who started his career within PwC and spent 10 years with ship manufacturer Austal, where he was responsible for managing the Finance, Accounting, IT and HR functions. – Mr. Wheeler then joined global trading and shipping player, Wellard and was responsible for its financial systems and processes. – He is a member of Chartered Accountants of Australia and New Zealand.
James Doyle Company Secretary	– Mr. Doyle is an experienced advisory and governance professional specialising in the provision of company secretarial and corporate advisory services to public and private companies across a range of sectors including resources, industrials and technology. – He has significant experience in equity and debt capital raisings, IPOs, mergers and acquisitions, private equity investment, and investor relations. – Mr. Doyle holds a Bachelor of Commerce from the University of Western Australia and a graduate Diploma of Applied Finance.
Steuart McIntyre GM Corporate Development	– Mr. McIntyre is a mining analyst with over 15 years' experience. – His previous roles include sell-side mining analyst for Royal Bank of Canada and Blue Ocean Equities and associate at Cutfield Freeman. – He has degrees in Civil Engineering and Commerce from the University of Sydney and a diploma of corporate finance from the London Business School.

Daniel Pantany GM Engineering and Technical	– Mr. Pantany has over 22 years' experience in mining project development in Africa and Australia. – His most recent position was with CPC Engineering including secondment as Project Engineering Manager for Syrah's Balama project. He has been the company's Study Manager for Mahenge since 2018. – He holds a Bachelor of Engineering (Civil) from the University of Western Australia.
Raymond Hekima VP, Corporate (Tanzania)	– Mr. Hekima has over 13 years' experience in the government and corporate sectors, including permitting expertise. – He is responsible for overall business operations in Tanzania and in maintaining key relationships with government and local bodies. – Mr. Hekima holds a BSc Environmental Science and Management from Sokoine University of Agriculture, Tanzania.

Source: Company

Appendix I – Glossary

All in Sustaining Costs (AISC) – These costs include adjusted operating costs and sustaining capital expenditure, corporate general and administrative expenses, and exploration expenses reflecting the full cost of production from current operations.

C1 costs – Includes direct costs, which involve costs incurred in mining and processing (labour, power, reagents, materials) plus local general and administrative expenses, freight and realisation, and selling costs. Any by-product revenue is credited against costs at this stage.

Grade – The amount of metal in each tonne of ore, usually expressed as a percentage.

Internal Rate of Return (IRR) – IRR is the expected compound annual rate of return that is likely to be earned on a project or investment. It is the discount rate that makes the NPV of a project = 0.

Loss on Ignition (LOI) – It is a test used in inorganic analytical chemistry and soil science, particularly in the analysis of minerals and chemical makeup of soil. It involves heating a sample of the material at a specified temperature allowing volatile substances to escape until its mass ceases to change.

Mineral Resources (JORC Code) – A concentration or occurrence of solid material of economic interest in or on the earth's crust in such a form, grade/quality, and quantity that are reasonable for eventual economic extraction. Mineral Resources are subdivided, in order of increasing geological confidence, into Inferred, Indicated and Measured categories.

Net Present Value (NPV) – It is a technique used in capital budgeting and investment planning to analyse the feasibility of a projected investment or project. It is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.

Offtake agreement – An arrangement between a producer and buyer to buy and sell portions of the producer's future goods. It is normally negotiated

before the construction of a factory or facility to secure a market and revenue stream for its future output.

Open Pit – A mine where the minerals are mined entirely from the surface.

Ore Reserves (JORC Code) – The economically mineable part of a Measured and/or Indicated Mineral Resource. Reserves are either Probable or Proved Reserves. While "Probable Ore Reserve" is the economically mineable part of an Indicated, and in some circumstances, a Measured Mineral Resource, "Proved Ore Reserve" is the economically mineable part of a Measured Mineral Resource.

Spheronisation – It is a process where extrudates (the output from an extruder) are shaped into small rounded or spherical granules. Spheronisation improves a product's performance by producing a smooth particle surface suitable for thin layer coating.

Stripping Ratio – A strip ratio, or stripping ratio, is an important measurement related to the open-pit mining process. It represents the amount of waste material (also known as overburden) that must be moved in order to extract a given amount of ore.

Appendix II – Major Shareholders

Investor Name	Ownership (%)
POSCO Holdings Inc.	12.90%
Copulus Group of Companies	6.02%
Copulos, Stephen Former Non-Executive Director	5.10%

Source: S&P Capital IQ

Appendix III – Capital Structure

Class	In millions	% of fully diluted	Note
Ordinary fully paid shares	977.3	93.9%	
Options	63.9	6.1%	Wtd. avg. exercise price of A$0.12 with wtd. avg. exercise date of 31-Aug-23
Perfomance rights	-		
Fully diluted shares	**1,041.2**		

Source: Company

Appendix IV – Analysts' Qualifications

Stuart Roberts, lead analyst on this report, has been an equities analyst since 2002.

- Stuart obtained a Master of Applied Finance and Investment from the Securities Institute of Australia in 2002. Previously, from the Securities Institute of Australia, he obtained a Certificate of Financial Markets (1994) and a Graduate Diploma in Finance and Investment (1999).
- Stuart joined Southern Cross Equities as an equities analyst in April 2001. From February 2002 to July 2013, his research speciality at Southern Cross Equities and its acquirer, Bell Potter Securities, was Healthcare and Biotechnology. During this time, he covered a variety of established healthcare companies, such as CSL, Cochlear and Resmed, as well as numerous emerging companies. Stuart was a Healthcare and Biotechnology analyst at Baillieu Holst from October 2013 to January 2015.
- After 15 months over 2015–2016 doing Investor Relations for two ASX-listed cancer drug developers, Stuart founded NDF Research in May 2016 to provide issuer-sponsored equity research on ASX-listed Life Sciences companies.
- In July 2016, with Marc Kennis, Stuart co-founded Pitt Street Research Pty Ltd, which provides issuer-sponsored research on ASX-listed companies across the entire market, including Life Sciences companies.
- Since 2018, Stuart has led Pitt Street Research's Resources Sector franchise, spearheading research on both mining and energy companies.

Nick Sundich is an equities research analyst at Pitt Street Research.

- Nick obtained a Bachelor of Commerce/Bachelor of Arts from the University of Sydney in 2018. He has also completed the CFA Investment Foundations program.
- He joined Pitt Street Research in January 2022. Previously he worked for over three years as a financial journalist at Stockhead.
- While at university, he worked for a handful of corporate advisory firms.

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